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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MCCRACKEN, DANIEL	

ART UNIT	PAPER NUMBER
1754	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/509,575	IIJIMA ET AL.	
	Examiner	Art Unit	
	Daniel C. McCracken	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Citation to the Specification will be in the following format (S. # : ¶) where # denotes the page number and ¶ denotes the paragraph number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Information Disclosure Statement

The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

The information disclosure statement filed 9/29/2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

The Examiner requests any and all documents cited against this application and any related applications (parent/child/PCT) by this or any other patent office. Such information is considered material to patentability. Appropriate translations are expected.

Specification

A substitute specification excluding the claims is required pursuant to 37 CFR 1.125(a) because the number of amendments to the specification needed to correct all of the deficiencies would make it difficult to consider the application.

A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter.

The Specification suffers from poor diction, syntax, and grammatical form, possibly from a machine translation from Japanese. For example, Applicants state:

> Heretofore, chemical vapor deposition (CVD) methods have been specifically given attention in production of high-quality single-walled carbon nanotubes (SWNTs), that are extremely useful in various industries.

(S. 1, 2). (noting the use of the passive voice). If this sentence reads well in Japanese, it does not read well in English. Further, it would appear as if the Specification was not proofread before filing. *See e.g.* (S. 5, 3) ("hereinunder [*sic*]") (it would appear as if "hereunder" was intended). This listing is merely exemplary of the types of errors in the specification and is by no means exhaustive. Applicants are requested to give the Specification a thorough and thoughtful review to place it in proper idiomatic English.

A substitute specification must not contain new matter. The substitute specification must be submitted with markings showing all the changes relative to the immediate prior version of the specification of record. The text of any added subject matter must be shown by underlining the added text. The text of any deleted matter must be shown by strike-through except that double brackets placed before and after the deleted characters may be used to show deletion of

five or fewer consecutive characters. The text of any deleted subject matter must be shown by being placed within double brackets if strike-through cannot be easily perceived. An accompanying clean version (without markings) and a statement that the substitute specification contains no new matter must also be supplied. Numbering the paragraphs of the specification of record is not considered a change that must be shown.

Priority

As a reference with in intervening date (i.e. after the foreign priority date but before the U.S./PCT filing date) has been applied to the Claims, Applicants are requested to provide a translation of the certified copy(s) of the foreign priority application(s). *See* MPEP 201.15.

Failure to provide a certified translation may result in no benefit being accorded for the non-English application.

Inventorship

As a reference that discloses the subject matter being claimed with inventorship/authorship *different* than that of the instant application has been made of record, Applicants are requested to provide a satisfactory showing by way of affidavit under 37 CFR 1.132 that the inventorship of the application is correct. *See In re Katz*, 687 F.2d 450, 455, 215 USPQ 14, 18 (CCPA 1982).

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 7 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants have failed to present any experimental evidence or a reduction to practice of the hydroxyapatite embodiment. While a reduction to practice isn't the gravaman of the written description requirement, the Examiner considers it highly relevant here, given the demonstrated unpredictability of nanotube growth on different substrates. *See* (S. 14: 4). Further, the scant mentioning of hydroxyapatite at (S. 4: 1) and (S. 6: 1) does not convey to one of ordinary skill in the art that applicants had the invention in their possession at the time of filing.

Claim 7 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for sapphire substrates, does not reasonably provide enablement for hydroxyapatite substrates. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with these claims. While Applicants do mention hydroxyapatite in the specification at (S. 4: 1) and (S. 6: 1), Applicants present little more than that – no experimental evidence, no "exact terms" discussing the "manner of using" the hydroxyapatite substrate. The comparative examples recited in Applicants specification demonstrate unpredictability between different substrates. Hydroxyapatite was not demonstrated in any of the comparative examples. One seeking to practice the invention with hydroxyapatite would be subjected to unduly

burdensome experimentation, unaided by Applicants lack of enabling guidance and a demonstrated reduction to practice.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the "certain correspondence" between the single-crystal substrate and the metal catalyst.

With respect to Claim 9, the "A-plane, R-plane or C-plane" is an arbitrary designation, indefinite in light of the Specification. Arguments traversing this rejection should address the following question: "What would infringe Claim 9, and where is this information found in the Specification?"

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The entire reference teaches each and every limitation of the rejected claims. The pinpoint citations provided are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found.

Claims 1-11 rejected under 35 U.S.C. 102(b) as being anticipated by Hongo, et al., *Chemical vapor deposition of single-wall carbon nanotubes on iron-film-coated sapphire substrates*, Chem. Phys. Ltr. 361 (2002) 349-354 (hereinafter "Hongo"). The July 30, 2002 publication date of the Hongo article and the earliest effective US filing date (9/29/2004) serve as the basis for the rejection under 102(b).

Clearly, this reference discloses the subject matter of the instant application. This rejection may be obviated by filing a translation of the certified priority documents that makes a satisfactory showing that Applicants are in fact entitled to the Japanese priority date. This does not resolve any issues related to inventorship, however.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The references cited teach each and every limitation of the rejected claims. The pinpoint citations provided are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found.

Claims 1-6, 8, and 10-11 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Su, et al., *Lattice-Growth of Single-Walled Carbon Nanotubes*, J. Phys. Chem. B 104 (28) pp.6505-6508 (2000) (hereinafter "Su at __.").

With respect to Claims 1, 5-6 and 10, Su discloses dispersing a metal catalyst on a silicon substrate. (Su at 6505, col. 2). A CVD process, operating at 900°C is recited. (Su at 6507, col. 1).

The crystallographic designation (i.e. "Si(100)") used by Su as well as the "clean" energy interaction figures (Su, "Fig. 2") would appear to indicate a single-crystal substrate. As to Claims 2-4, thin layers of iron nanoparticles are recited. (Su at 6506). As to Claim 8, nanotube diameter control is recited. (Su at 6507, col. 1). As to Claim 11, methane is recited. (Su at 6505, col. 2).

To the extent Su may not disclose the thickness of the catalyst film as claimed, it is expected that the thickness is necessarily recited, owing to the similarity of deposition methods. *Compare* (S. 7: 1) *with* (Su at 6506).

Claims 1-6, 8, and 10-11 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Fan, et al., *Self-Oriented Regular Arrays of Carbon Nanotubes and Their Field Emission Properties*, Science 283 (5401) pp. 512-514 (22 January 1999) (hereinafter "Fan at __.").

With respect to Claims 1, 5-6 and 10, Fan discloses dispersing a metal catalyst on a silicon substrate. (Fan at 512, col. 1). No difference is seen between Fan and the crystallographic structure recited by the claims. A CVD process, operating at 700°C is recited. (Fan at 512, col. 2). As to Claims 2-4, Fan recites a 5 nm thick iron film. *Id.* As to Claim 8, nanotube diameter control is recited. (Fan at 512, col. 3). As to Claim 11, ethylene is recited. (Fan at 513, col. 1).

Claims 1-8 and 10-11 rejected under 35 U.S.C. 103(a) as being unpatentable over Fan, et al., *Self-Oriented Regular Arrays of Carbon Nanotubes and Their Field Emission Properties*, Science 283 (5401) pp. 512-514 (22 January 1999) and Su, et al., *Lattice-Growth of Single-*

Walled Carbon Nanotubes, J. Phys. Chem. B 104 (28) pp.6505-6508 (2000) in view of Wu, et al., *Carbon Nanowalls Grown by Microwave Plasma Chemical Vapor Deposition*, Adv. Mater. 2002, 14, no.1, pp. 64-67 (2002) (hereinafter "Wu at __.").

With respect to Claims 1-6, 8, and 10-11, the Examiner is taking official notice that the general process of depositing a catalyst on a substrate and performing a chemical vapor deposition process to grow carbon nanotubes for the reagents and catalysts claimed is old and known. In support of taking official notice, the Examiner cites to Fan and Su as thorough, but by no means exhaustive treatments of CVD processes known before Applicants earliest priority date. As to Claim 7, to the extent Fan and Su may not disclose the use of a sapphire substrate, Wu does. *See* (Wu at 66). One would be motivated to utilize a sapphire substrate in a conventional CVD process as recited by Fan and Su because of the ability alter nanotube morphology, as disclosed by Wu. *Id.*

Claims 1-8 and 10-11 rejected under 35 U.S.C. 103(a) as being unpatentable over Fan, et al., *Self-Oriented Regular Arrays of Carbon Nanotubes and Their Field Emission Properties*, Science 283 (5401) pp. 512-514 (22 January 1999) and Su, et al., *Lattice-Growth of Single-Walled Carbon Nanotubes*, J. Phys. Chem. B 104 (28) pp.6505-6508 (2000) in view of US 6,232,706 to Dai, et al.

With respect to Claims 1-6, 8, and 10-11, the Examiner is taking official notice that the general process of depositing a catalyst on a substrate and performing a chemical vapor deposition process to grow carbon nanotubes for the reagents and catalysts claimed is old and known. In support of taking official notice, the Examiner cites to Fan and Su as thorough, but by

no means exhaustive treatments of CVD processes known before Applicants earliest priority date. As to Claim 7, to the extent Fan and Su may not disclose the use of a sapphire substrate, Dai does. *See* (Dai 5: 55-62). Dai is taken as recognizing numerous equivalents known for the same purpose, the substitution of one for another is prima facie obvious. *See* MPEP 2144.06.

Claims 1-6 and 8-11 rejected under 35 U.S.C. 103(a) as being unpatentable over Fan, et al., *Self-Oriented Regular Arrays of Carbon Nanotubes and Their Field Emission Properties*, Science 283 (5401) pp. 512-514 (22 January 1999) and Su, et al., *Lattice-Growth of Single-Walled Carbon Nanotubes*, J. Phys. Chem. B 104 (28) pp.6505-6508 (2000) in view of Stewart, et al., *Chemical and Biological Applications of Porous Silicon Technology*, Adv. Mater. 2000, 12, No. 12 pp. 859-869 (hereinafter "Stewart at __.").

With respect to Claims 1-6, 8, and 10-11, the Examiner is taking official notice that the general process of depositing a catalyst on a substrate and performing a chemical vapor deposition process to grow carbon nanotubes for the reagents and catalysts claimed is old and known. In support of taking official notice, the Examiner cites to Fan and Su as thorough, but by no means exhaustive treatments of CVD processes known before Applicants earliest priority date. As to Claim 7, to the extent Fan and Su may not disclose the use of a hydroxyapatite substrate in connection with nanotube synthesis, Stewart does. *See* (Stewart at 865-867). Stewart generally recites the mass transfer phenomena associated with CVD growth of carbon nanotubes, identifying porosity as a result effective variable, controlling the flow of the gas to the catalyst. (Stewart at 866). Hydroxyapatite is identified as a substrate that can further control mass transfer. (Stewart at 867). One would be motivated to combine the a hydroxyapatite substrate as taught by

Stewart with a CVD process as taught by Fan or Su because of the additional mass transfer options it presents.

Conclusion

All amendments made in response to this Office Action must be accompanied by a pinpoint citation to the Specification (i.e. page and paragraph or line number) to indicate where Applicants are drawing their support.

The Examiner makes record of the following as pertinent to Applicants disclosure:

1. Ward, et al., *Substrate effects on the growth of carbon nanotubes by thermal decomposition of methane*, Chem. Phys. Ltr. 376 (2003) 717-725.

2. US 6,420,293 B1 to Chang, et al

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel C. McCracken whose telephone number is (571) 272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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